FINAL SUBMISSION

TWIN CITIES ARMY AMMUNITION PLANT
NEW BRIGHTON, MINNESOTA

ENERGY ENGINEERING ANALYSIS

EXECUTIVE SUMMARY

prepared for
U.S ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

prepared by
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July 5, 1983

U. S. Army Corps of Engineers
Omaha District
6014 U. S. Post Office and Court House
Omaha, NE 68102

Attention: MRCED-MC

Reference: Energy Engineering Analysis
Twin Cities Army Ammunition Plant
New Brighton, MN

Subject: Energy Engineering Analysis - Final Submission

Contract No.: DACA-5-83-C-0090

Our Project No.: 05-4660

Gentlemen:

This letter transmits the Final Submission of the Energy Engineering Analysis for the Twin Cities Army Ammunition Plant, New Brighton, Minnesota. The Analysis presents energy conservation projects that will enable the plant to meet energy consumption reduction goals, as specified in the Army Facilities Energy Plan.

The Analysis consists of nine components:

- Executive Summary
- Technical Report
- Appendix I: Master Building List
- Appendix II: Energy Conservation Calculations and Data
- Appendix III: Energy Conservation Measures Summaries
- Appendix III: Energy Conservation Measures
- Project Programming Documents
- Modified Increment I Study
- Increment F Study

All comments have been reviewed and incorporated in the report, as appropriate.

This Energy Engineering Analysis is a valuable data base that can be used for the development of additional projects as Army goals are revised and other energy conservation projects become viable.

The assistance that was provided by plant and COE personnel proved invaluable in completing this assignment. We appreciate their cooperation and hospitality.

Thank you for this opportunity to be of service.

Very truly yours,

STV/SANDERS & THOMAS

David M. Jonik, P.E.
Project Manager

DMJ:mat

PROJECT ABSTRACT

ENERGY ENGINEERING ANALYSIS
TWIN CITIES ARMY AMMUNITION PLANT

This analysis is undertaken to assist the Twin Cities Army Ammunition Plant (TCAAP) in meeting the goals established by the Army Facilities Energy Plan to reduce energy consumption by 20 percent by FY 85.

Projects selected for implementation as a result of this analysis will enable TCAAP to achieve the FY 85 goal. These projects have been divided into standby and mobilization status. Total energy savings resulting from standby status project implementation will be approximately 130,800 MBTU's at a total estimated cost of $4.2 million. If mobilization status projects are implemented annual energy savings will be approximately 626,300 MBTU's during periods of full mobilization. The cost of implementing mobilization status projects is estimated at $12.9 million.

USE OF THE REPORT

This Energy Engineering Analysis consists of a main report, which describes the existing and anticipated energy use trends, and defines and summarizes specific energy conservation projects recommended to achieve the goals stated in the Army Facilities Energy Plan. Appendices and the Annual Energy Consumption Summary include building information, weather data, cost data, and detailed computer-generated and manual calculations for each individual project.

The Energy Engineering Analysis will enable ammunition plant personnel to identify energy conservation measure and meet Army energy reduction goals.

The report includes:

- Energy consumption by fuel type;
- energy consumption trends;
- ECAM projects;
- Increment F and G Project;
- other potential projects;
- quick-fix management form; and
- descriptions of analyzed buildings.

In addition, the Analysis is a detailed data base consisting of:

- An analysis of building energy use;
- Energy Conservation Measures applied to each analyzed building to be improved; and
- a set of marked-up prints from the survey indicating the conditions when surveyed.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

1.1 PROJECT REQUIREMENT

This engineering analysis is undertaken in order to develop a systematic program of projects that will lead to energy consumption reductions at the Twin Cities Army Ammunition Plant (TCAAP) without compromising the mission of the plant, and in compliance with all applicable environmental and Occupational Safety and Health Administration regulations. Reduced energy consumption is a stated goal of the Army Facilities Energy Plan.

The projects included in this analysis are grouped into five increments: A - Energy Conservation and Management Program (ECAM) Projects for Buildings and Processes, B - ECAM Projects for Utilities and Energy Distribution Systems, Modified E - Central Boiler System Projects, F - Energy Saving Modifications within the Facilities Engineer's Control, and G - Minor Construction, Maintenance, and Repair Projects not ECAM Qualified.

2.1 PLANT DESCRIPTION

TCAAP is located in New Brighton, Minnesota, approximately five miles north of the Twin Cities of Minneapolis and St. Paul. See Figure 1: Twin Cities Army Ammunition Plant Location Map. The plant covers about 2,370 acres and consists of 262 enclosed buildings with a total floor area of about 4.4 million square feet. Figure 2: Twin Cities Army Ammunition Plant Site Map, shows the main features of the plant.

The Federal Cartridge Corporation and the Donovan Construction Company are the operating contractors designated to carry out the plant's mission, which is to produce the following ammunition:

5.56mm cartridges
7.62mm cartridges
155mm shells
Tracers
Primers

TCAAP is currently on standby status.

3.1 ARMY FACILITIES ENERGY PLAN

The Army Facilities Energy Plan sets short and long range energy goals for the Army and provides policy and planning guidance for the development of detailed facility energy plans. The Army's energy goals in effect at the time of our scope of work, compared to present goals, are as shown in Table 1: Comparison of Army Facilities Energy Plan Goals.

FIGURE 1
TWIN CITIES ARMY AMMUNITION PLANT
LOCATION MAP

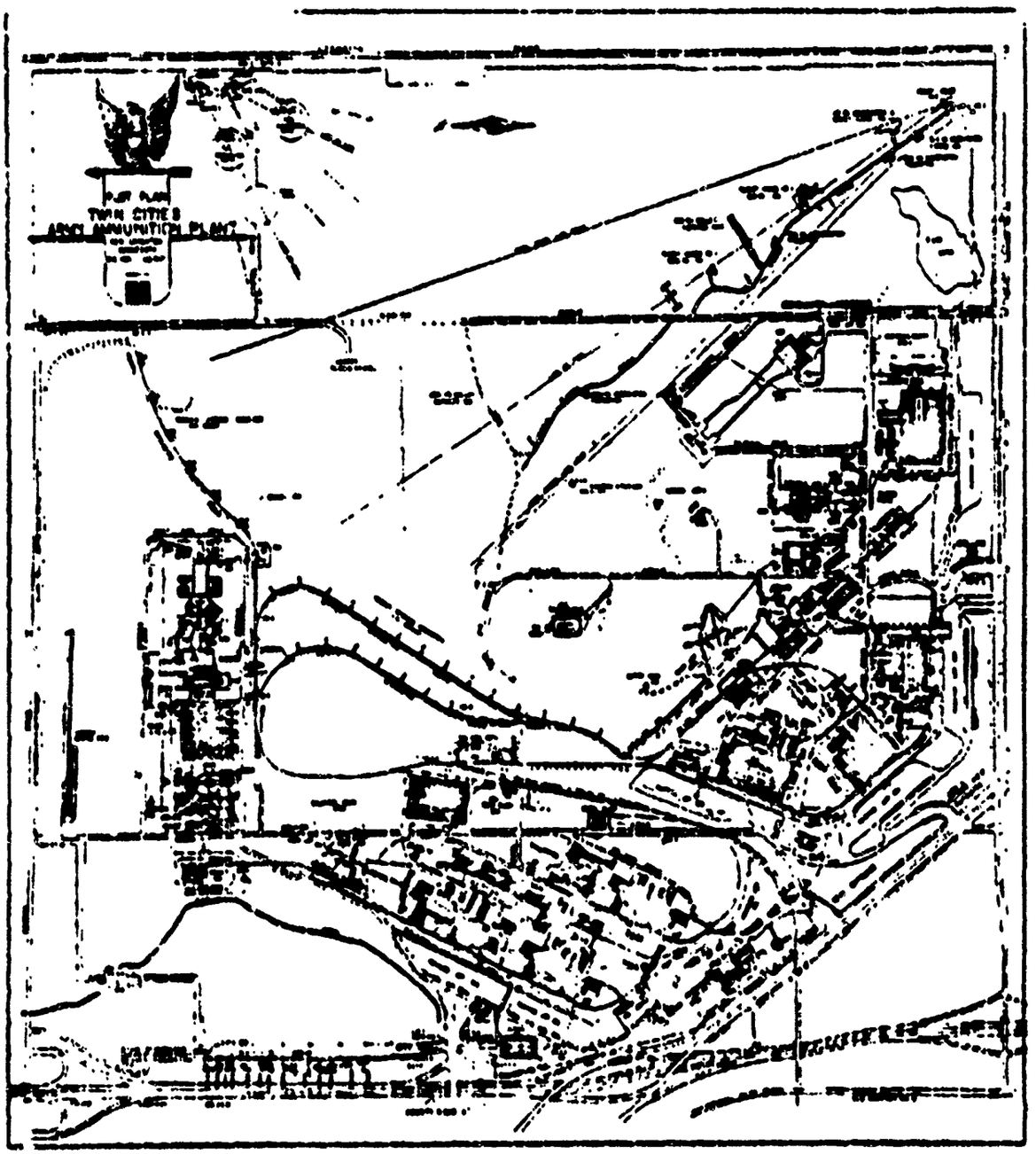


FIGURE 2
TWIN CITIES ARMY AMMUNITION PLANT
SITE MAP

TABLE 1
COMPARISON OF ARMY FACILITIES ENERGY PLAN GOALS

	1 OCT 1978	26 DEC 1981
Reduce total consumption by:	25% by FY 85 50% by FY 2000	20% by FY 85 40% by FY 2000
Energy from coal & RDF	10% by FY 85	N.M.
Solar energy	1% by FY 85	N.M.
Natural gas	Eliminate use by FY 2000	N.M.
Petroleum fuels	Reduce by 75% by FY 2000	N.M.
Capability for synthetic gases	N.M.	By FY 2000
Heating oil consumption	N.M.	Reduce by 75% by FY 2000

N.M. - Not Mentioned.

The program recommended in this EEA report is consistent with revised Army Facilities Energy Plan goals as stated in the 26 October 1981 version.

4.1 SOURCE ENERGY CONSUMPTION

Table 2: Source Energy Consumption, compares energy consumption at TCAAP from FY 1975, the base year for the study, with consumption during FY 1979. Energy consumption over the period decreased by about 50 percent. This is primarily attributed to the cessation of production as well as energy conservation measures.

TABLE 2
TCAAP SOURCE ENERGY CONSUMPTION
FY 1975 AND 1979

	FY 1975		FY 1979	
Source	Cost ($000)	MBTU's Consumed (000)	Cost ($000)	MBTU's Consumed (000)
Electricity	$1,050	667	$ 696	334
Fuel Oil No. 2	706	326	791	326
Natural Gas	707	693	351	165
Totals	$2,463	1,586	$1,838	825

Current fuel consumption is primarily attributed to building rather than process requirements.

5.1 PROJECT EXECUTION

This energy engineering analysis was conducted in four phases:

- Field surveys and data gathering
- Analysis of projects
- Review and verification
- Preparation of Project Programming Documents

5.1.1 Field Surveys and Data Gathering

The field surveys included buildings and process surveys. The building surveys were conducted in four areas:

- Architectural - to evaluate such items as wall and roof types, and levels of insulation
- Mechanical - to evaluate heating, ventilating, and air conditioning
- Electrical - to evaluate lighting and building electrical systems
- Distribution - to evaluate plant utility systems

The process surveys addressed the process systems located at the plant including production of 5.56 and 7.62mm cartridges, 155mm shells, tracers, and primers, as well as the various recovery systems in operation.

The distribution surveys covered all plant utility systems including electrical, steam, natural gas, water, sewage, and compressed air.

The survey phase enabled the identification of energy conservation opportunities and the applicability of energy conservation measures to TCAAP.

5.1.2 Analysis of Projects

After the data gathering phase it was possible to identify potential projects for analysis. These projects were analyzed for applicability to TCAAP and their potential to save energy in relation to their implementation cost.

Energy conservation measures were computer analyzed to develop energy savings and implementation costs. In addition, SAP, BCR and ECR values were computed. These latter three values, however, are no longer needed to determine project priorities. Instead, priorities are determined by Savings Investment Ratio

(SIR) using the methodology presented in the Energy Conservation Investment Program (ECIP) Guidance, dated 22 September 1982. Projects recommended for implementation in this report on the basis of ECR generally meet SIR criteria.

The Sanders & Thomas SIR Program is similar to the program presented in the ECIP Guidance, with the following exception:

> The discount factor is calculated directly from the C tables by determining the compounded single payment discount factors for each year, then finding their sum over the economic life of the project. This method makes it possible to consider different modes of operation (i.e. mobilization and peacetime) as might be the case for Army ammunition plants.

5.1.3 Review and Verification

TCAAP personnel assisted in the selection of those projects which should be implemented and developed project priorities. All projects were reviewed and verified at the plant in consultation with TCAAP personnel.

5.1.4 Preparation of Project Programming Documents

A DD Form 1391, Detailed Justification, and Project Development Brochure has been prepared for each selected ECAM project.

6.1 ENERGY CONSERVATION OPPORTUNITIES

The following energy conservation opportunities were investigated and found to be viable:

- Insulation
- Storm windows
- Caulking
- Consolidation of Building 105
- Weatherstripping
- Install shower flow restrictors
- Reduce ventilation requirements
- Prevent air stratification
- Load dock seals
- Reduce lighting levels
- Replace incandescent fixtures
- Install fluorescent fixtures
- Install high-efficiency fixtures
- Revise boiler controls
- Viscosity controls
- Install economizers
- Install new burners
- Reduce street lighting
- Insulate steam lines return concensate
- Steam distribution system pressure decrease

The following conservation opportunities were studied but found not viable because of low ECR or lack of conservation opportunity at the plant:

- Replace kitchen lighting fixtures
- Improve power factor
- High-efficiency motor replacement
- FM radio controls
- Decentralize domestic hot water heaters
- Reclaim heat from hot refrigerant gas
- Install chiller controls
- Replace chillers
- Solar films
- Blowdown heat recovery
- Construct vestibules
- Replace existing transformers with new units having lower characteristic impedances
- Cogeneration projects
- Steam distribution system leak repair
- Steam distribution condensate recovery
- Off-peak operation of well pumps
- Capacitors on well pump motors
- Off-peak operation of sewage pumps
- Combustion air preheaters for boiler stacks
- Revise ventilation and heating for the gun rooms in Building 308
- Draw furnace combustion air preheating
- Heat recovery from Colt washers and dryers
- Rotary forge air heater
- Salem furnace exhaust gases used for Salem dryer
- Insulate condensate return lines
- Ducted heat destratification
- Insulation projects for building 139-A, 139-B, 139-C, 139-D, 141-A, 141-B, 144-A through H, 149-A through D
- Air washer-humidifier for Building 135
- Use process heat to heat buildings and shutdown comfort heat steam
- Seal abandoned electric motor houses
- Install timers on HVAC equipment
- Reduce ceiling height
- Change constant volume AHU to variable air volume AHU
- Install blowdown fans in heated high bay areas
- Use economizer cycle
- Use enthalpy controlled economizer cycle
- Reset controls for hot and cold decks on duel ducts, multizone, and terminal reheat units.

7.1 OTHER PROJECTS CONSIDERED

7.1.1 Compressor Cooling Water Systems for Buildings 101, 102, 501 and 503

These projects conserve water by recirculating air compressor cooling water through a closed-loop cooling tower arrangement.

These are not energy conservation projects. With the addition of the cooling tower and associated equipment, the amount of energy consumed will be the same or slightly more than that used to originally pump the cooling water. However, with the exception of Building 102 (to be leased), the significant savings incurred by not treating the cooling water at the sewage treatment plants make these feasible and highly recommended projects.

8.1 PROJECTS SUMMARY

8.1.1 Introduction

ECAM, Increment G, and other projects are separately listed according to descending ECR. A summary of project categories completes this section in Table 9: Summary of Projects.

8.1.2 Selected ECAM Projects

ECAM Projects selected by TCAAP personnel at the Review and Verification Meeting are presented in Table 3: Selected ECAM Projects. Projects are separated by fiscal year and by standby or mobilization status and listed in order of descending ECR. Plant priorities may vary from the prioritized ECR's. The plant will decide which projects are to be implemented based on the actual present requirements.

8.1.3 Viable Projects Not Selected for Implementation by TCAAP

Table 4: Viable Projects Not Selected for Implementation by TCAAP, includes those projects not selected for implementation by TCAAP personnel. These projects were not selected because anticipated procedural changes at the plant would make these projects unnecessary and other projects have accomplished the same purpose. Projects are separated by fiscal year and by standby or mobilization status and listed in order of descending ECR.

8.1.4 Energy Conservation Measures Not Meeting ECAM Criteria

These portions of ECM Nos. 2 through 8 not included in selected ECAM projects or Increment G projects are listed in Table 5: Energy Conservation Measures Not Meeting ECAM Criteria. Annual MBTU savings, CWE, TIC, and ECR data are included for the unselected portion of each ECM. A complete itemization of individual building projects from which future implementation selection could be made appears in Appendix III of the EEA dated May 28, 1982.

8.1.5 Steam/Power Plant Modernization (Modified Increment E)

An analysis of various methods of improving the steam/power plants showed that the preferred approach was to convert Boiler Plant 515 to fire coal, expanding its capacity to meet mobilization requirements.

8.1.6 Increment F Projects

Increment F projects for Building 535 will save approximately 950 MBTU's per year and will produce a first year savings of about $4,000. These projects are listed in Table 6: Potential Energy Conservation Projects Developed for Building 535 (Standby Status).

Recommendations were made concerning the advantages of using gas versus electric annealers viable projects to more accurately control temperatures in Buildings 101, 108, 112, 135, 501, and 503 are presented in Table 7. The most economical method of heating and controlling the temperature in Building 501 was reviewed. These analyses showed that the existing gas annealers should be retained; that projects for improved temperature control will save 7,800 MBTU's per year and $42,000 in energy costs in the first year after implementation; and that recommendations for Building 501 will save 185 MBTU's per year or $1,800 the first year after implementation.

8.1.7 Increment G Minor Construction, Maintenance and Repair Projects

Table 8: Increment G Minor Construction, Maintenance and Repair Projects, lists qualifying projects by descending ECR.

8.1.8 Projected Energy Trends

Figure 3: Standby Status - Projected Energy Consumption, shows the projected trend in energy consumption over the period FY 1975 to FY 2000. During FY 1985, when the energy projects will be implemented, energy use will be reduced by approximately 93,000 MBTU's per year. Building energy usage per square foot will be reduced from 399 to 123 KBTU's per gross square foot per year from FY 1975 through FY 1985.

TABLE 3
SELECTED ECAM PROJECTS

Project No.	Project Title	Annual MBTU Savings	Annual Cost Savings ($000)	Benefits ($000)	CIR ($000)	IIC ($000)	SAP	BCR	ECR
	FY 80 Mobilization Status								
11-1	Energy Monitoring and Control System	244,500	2,336	30,959	2,754	2,899	1.2	10.7	88.8
5-16	Buildings 101, 501, 503, High Bay Fans for Heat Destratification	111,000	706	14,220	1,345	1,416	1.9	10.0	82.9
9-5	Recover Heat from Salem Hot Water Rinse, Buildings 503 and 101	7,650	46	914	108	110	2.3	8.2	73.3
5-11	Replace Lighting Fixtures in Building 170	28,900	99	1,797	410	432	4.1	4.2	68.4
5-71	Insulate Condensate Return Lines, Buildings 501 and 503	10,500	63	1,259	164	170	2.6	7.4	65.0
5-12	Replace Lighting Fixtures in Selected Buildings	71,200	252	8,539	1,358	1,429	5.4	3.2	57.5
9-3	Recover Heat from Salem Furnaces in Buildings 101 and 503	67,600	284	5,688	1,330	1,400	4.7	4.1	35.8
9-8	Mesing Furnace Heat Recovery, Building 501	11,500	68	1,367	388	408	5.7	3.4	29.6
5-70	Weatherstrip and Caulk Windows and Doors, Install Storm Windows in Primer and Miscellaneous Buildings	3,820	31	617	121	134	4.1	4.6	23.1
5-2	Install Wall and Roof Insulation in Primer and Miscellaneous Buildings	14,660	109	2,995	625	658	4.2	4.6	23.5
9-7	Rotary Forge Furnace, Heat Recovery, Building 501	28,650	171	3,473	1,625	1,710	9.5	2.0	17.6
9-4	Recover Heat from Salem Furnace in Building 503	2,000	17	336	160	168	9.6	2.0	17.5
5-3	Install Insulated Panels over Windows in Primer and Miscellaneous Buildings	10,600	108	2,167	614	644	5.7	3.5	17.3
	Subtotal	597,770	4,330	73,775	11,004	11,588			

TABLE 3 (CONTINUED)

	FY 85 Standby Status								
7-6	Install Package Boilers in Buildings 115 and 515	37,000	150	3,836	947	629	4.0	4.0	63.4
8-5	Replace Insulation on 150 PSIG Steam Distribution System	50,700	402	8,004	3,895	3,164	7.5	2.5	18.3
	Subtotal	92,700	552	11,068	3,682	3,793			
	FY 85 Mobilization Status								
5-1	Install Wall and Roof Insulation to Primer and Miscellaneous Buildings	6,000	56	1,130	221	235	3.9	4.8	22.0
6-6	Replace Incandescent/Mercury Vapor Fixtures with High-Pressure Sodium Fixtures	8,000	42	704	581	606	10.0	1.2	15.0
	Subtotal	13,700	98	1,834	802	841			

TABLE 4
VIABLE PROJECTS NOT SELECTED FOR IMPLEMENTATION BY ICAAP

Project No.	Project Title	Annual MMBtu Savings	CMC ($1000)	CIC ($1000)	SAP	BCR	ERR
	FY 86 Mobilization Status						
S-15*	Building 501, Ducted Heat Destratification	7,750	176	186	4.1	3.9	48.2
S-14*	Building 503, Ducted Heat Destratification	5,400	300	316	9.3	1.7	18.8
	Subtotal	17,650	476	502			
	FY 88 Standby Status						
7-4	Install Economizers in Building 515	28,100	976	1,048	4.2	4.5	24.2
7-3	Install Economizers in Building 115	15,750	731	770	5.5	3.4	21.5
7-5	Replace Burners and Install Combustion Controls in Boiler Plant 515	21,200	1,202	1,265	6.7	2.8	17.7
	Subtotal	65,050	2,909	3,083			

*Project nos. S-14 and S-15 are not included in Table 6: Summary of Projects, due to the selection of project no. S-16: Install High Bay Fans in Buildings 108, 501, 503 - Mobilization Status.

TABLE 5

ENERGY CONSERVATION MEASURES NOT MEETING ECAM CRITERIA*

ECM No.	Annual MBTU Savings	FY 84 CHE ($000)	FY 84 IIC ($000)	ECR
2	30,400	3,079	3,241	9.9
3	11,000	352	371	31.2
4	3,300	587	618	5.6
5	6,600	340	358	19.4
6	2,000	380	399	5.3
7	3,800	560	591	6.8
8	0	0	0	N/A

*These portions of ECM Nos. 2 through 8, not included in selected ECAM projects or Increment G projects, are summarized in this table.

TABLE 6

POTENTIAL ENERGY CONSERVATION PROJECTS DEVELOPED FOR BUILDING NO. 535 (STANDBY STATUS)

Project No.	Project Title	Annual MBTU Savings	Total Investment ($)	First Year Dollar Savings ($)	Total Discounted Savings ($)	SIR
4-5	Remove Lamps and Fixtures	430	1,000	1,160	12,930	13.00
4-1	Install Insulated Panels Over Windows	420	8,240	2,290	28,000	3.40
4-2	Weatherstrip Doors	80	3,540	420	5,130	1.45
4-4	Caulk Windows	20	1,250	110	1,400	1.11

TABLE 7

POTENTIAL ENERGY CONSERVATION PROJECTS FOR TEMPERATURE CONTROL (STANDBY STATUS)

Project No.	Project Title	Annual MBTU Savings	Total Investment ($)	First Year Dollar Savings ($)	Total Discounted Savings ($)	SIR
	Temperature Control					
5-1	Building 101	2,380	37,200	12,900	158,100	4.24
5-5	Building 501	2,300	37,200	12,500	153,200	4.11
5-6	Building 503	1,910	56,800	10,400	126,900	2.24
5-3	Building 112	410	14,200	2,200	27,100	1.91
5-4	Building 135	450	17,700	2,400	29,900	1.69
5-2	Building 108	320	12,400	1,700	20,900	1.69
TOTAL		7,770	175,500	42,100	$16,100	2.94

TABLE 4

MILITARY & NAVAL CONSTRUCTION, PROGRAMMING AND REPAIR PROJECTS

Project No.	Project Title	Annual Fuel Savings	Annual Cost Savings ($000)	SIC ($000)	SCR	SIR	Payback
	FY 80 Standby Status						
5-72	Replace Lighting Fixtures in Buildings 115 and 116	3,000	30.6	61	52.2	2.6	1,000
8-6	Consolidation, Building 305	570	3.0	11	42.8	4.1	500
5-9	Install Self-Contained Thermostatic Valves on Radiation	700	7.3	8.9	32.5	3.0	800
5-19	Small Building Insulation Project						
	Buildings 1150-B (w/o floor insulation)*	500	4.2	9.7	50.2	2.0	70
	Buildings 1150-B (with floor insulation)	1000	5.2	10.2	57.4	2.9	100
	Building 5401	150	0.7	1.5	77.9	4.1	50
	Buildings 1210, 1210A and B	1400	1.0	6.2	20.9	6.2	1000
	Buildings 5420A and B	40	0.3	2.3	23.2	7.9	45
	Building 5190A (with floor insulation)	220	1.1	10.9	21.1	7.9	200
	Subtotal	5,270	29.9	120			

*This subproject is a duplication of a portion of the following subproject, Buildings 1150-B (with floor insulation), and is not included in the subtotal.

	FY 80 Mobilization Status						
5-13	Reduce the Number of Lamps	320	1.2	0.7	479	0.6	50
9-6	Recover Melt and Parts Heat from Salem Furnaces, Buildings 503 and 504	7,000	45	71	111	1.5	2,500
12-5	Loading Dock Door Seals, Building 190	800	4.8	12	72.7	2.3	80
9-10	Recover Melt and Parts Heat from Heating Furnaces, Building 504	6,000	28	60	72.3	2.3	2,400
12-1	Repair Compressed Air Leaks, Building 500	160	0.8	2.6	62.8	6.5	80
12-3	Repair Compressed Air Leaks, Building 504	200	0.9	3.5	62.1	6.5	110
12-4	Repair Compressed Air Leaks, Building 503	200	0.9	3.5	62.1	6.5	105
12-2	Repair Compressed Air Leaks, Building 135	30	0.01	0.6	50.0	3.0	20

TABLE 8 (CONTINUED)

9-11	Heat Recovery from Oil Quench, Building 501	1,700	9.9	24	50.1	3.0	8,000
9-9	Recover Belt and Parts Heat from Hardening Furnaces, Building 504	3,100	18	66	49.5	3.4	2,000
5-6	Install Insulated Window Panels in Miscellaneous Buildings	900	9.2	20	39.7	2.5	950
5-10	Install Self-Contained Thermostatic Valves on Radiators	378	3.8	23	36.9	5.8	8,850
12-6	Weatherstrip and Caulk, Building 590	318	2.3	19	34.9	8.0	400
8-1	Compressor Cooling Water System, Building 504	N/A	5	65	N/A	0.1	900
8-2	Compressor Cooling Water System, Building 503	N/A	200	35	N/A	0.2	500
8-3	Compressor Cooling Water System, Building 501	N/A	179	35	N/A	0.3	500
	Subtotal	28,298	463	460			
	69 Wk Standby Utility						
7-2	Viscosity Controller for Boiler Plant #15	10,000	60	36	286	0.4	1,000
7-7	Steam Distribution Pressure Decrease	12,600	300	50	296	9.5	2,200
7-1	Viscosity Controller for Boiler Plant #15	1,070	9	36	31.5	3.0	1,000
	Subtotal	24,160	283	170			

SAVINGS & PAYOUTS

TABLE 9
SUMMARY OF PROJECTS

ITEM	Annual MBTU Savings	TIC ($K00)
Selected ECAM Projects (Mobilization Status)	592,220	11,580
Viable Projects Not Selected (Mobilization Status)	17,650	502
Increment G Projects (Standby Status)	5,220	120
Increment G Projects (Mobilization Status)	20,290	460
TOTAL	630,380	12,662
FY 85		
Selected ECAM Projects (Standby Status)	92,700	3,793
Selected ECAM Projects (Mobilization Status)	13,760	841
Viable Projects Not Selected (Standby Status)	65,050	3,083
Increment G Projects (Standby Status)	24,160	126
TOTAL	195,670	7,843
Modified Increment E Projects ($1982)	----	59,000
Increment F Projects* (Standby Status) ($1983)	8,720	190

*Implementation of funded Increment F projects will be scheduled by the Facilities Engineer.

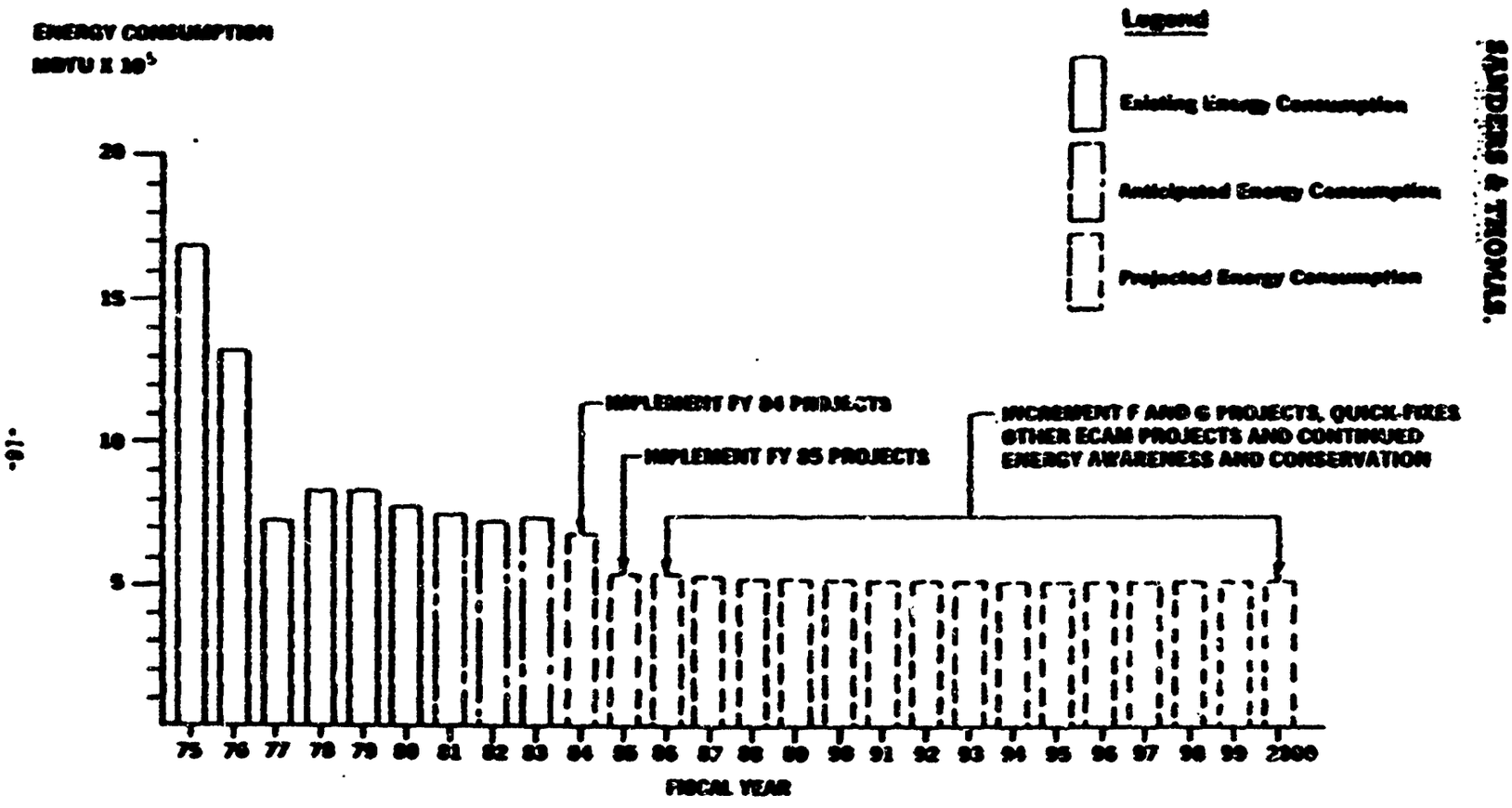
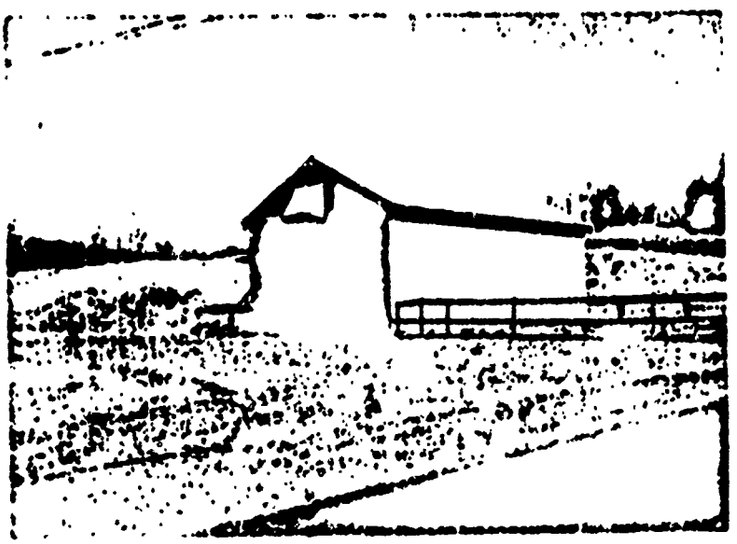
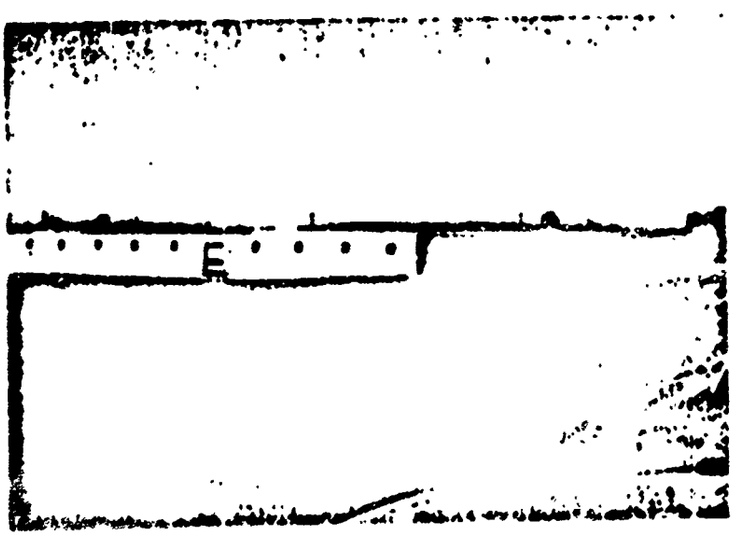


FIGURE 3

STANDBY STATUS — PROJECTED ENERGY CONSUMPTION

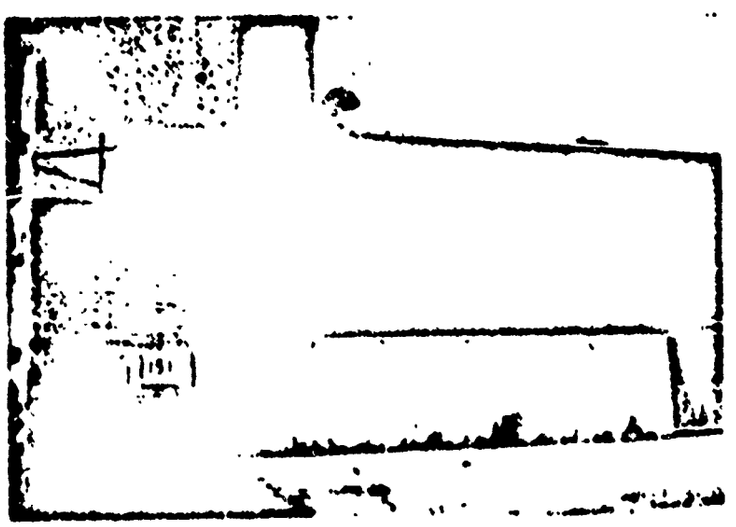


SMALL BUILDING INSULATION PROJECT
BUILDING #19-B BLACK POWDER STORAGE



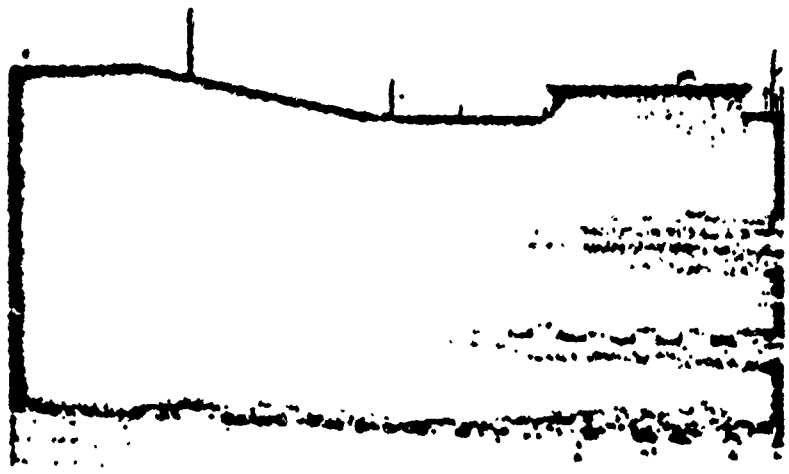
BUILDING 100 INSTALL TRUCK DOCK SEALS

PROJECT – REDUCE WINDOW LOSSES AT
BUILDING 181



PROJECT – REDUCE WINDOW LOSSES AT
BUILDING 181

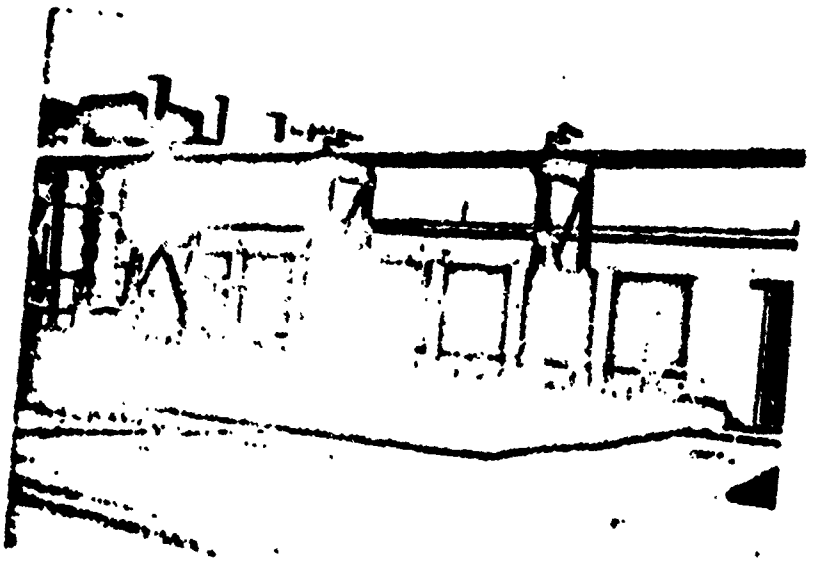
SANDERS & THOMAS.

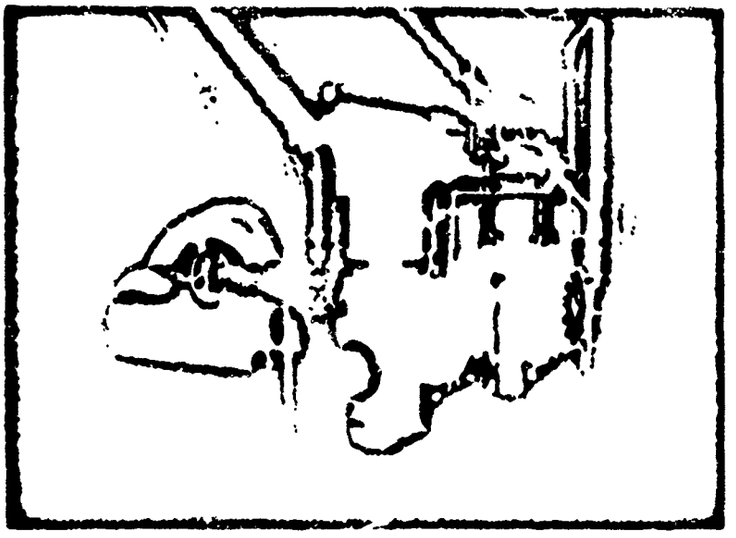


BUILDING 103 COMPLETED PROJECT COVERING
WINDOWS WITH INSULATED PANELS

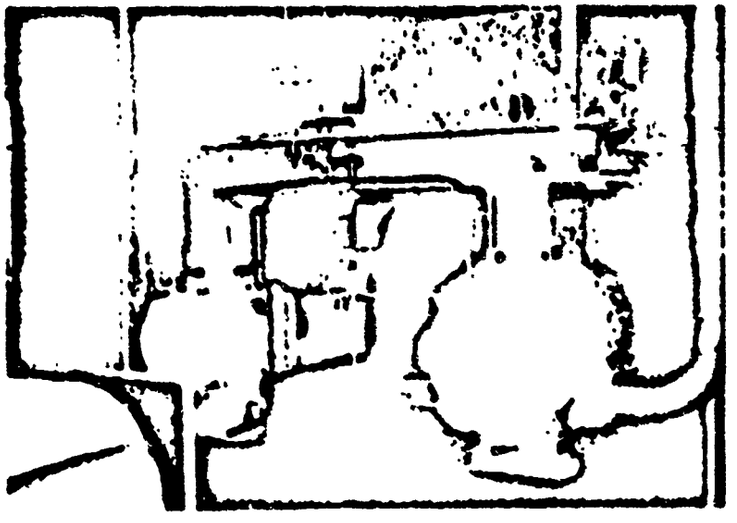
BUILDING 103 COMPLETED PROJECT COVERING
WINDOWS WITH INSULATED PANELS

TYPICAL STEAM DISTRIBUTION SYSTEM INSULATION
NOTE SETTLING OF INSULATION TO THE BOTTOM OF JACKET

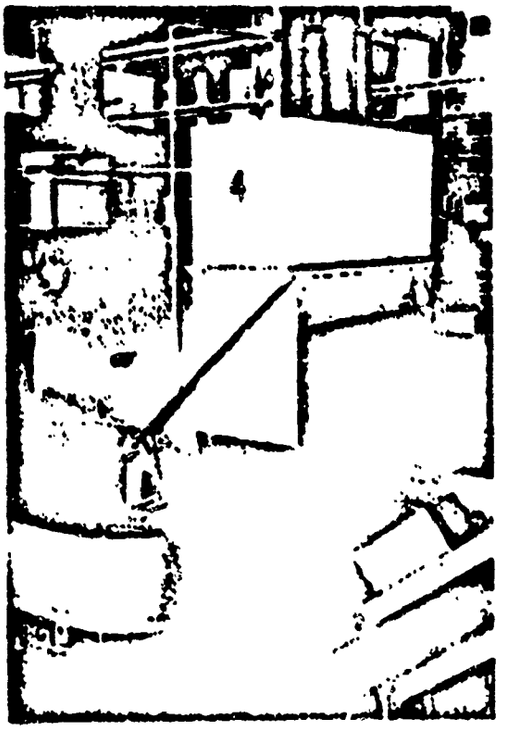




TYPICAL LARGE AIR COMPRESSORS
POTENTIAL ENERGY SAVINGS THROUGH THE
REDUCTION OF COOLING WATER USAGE

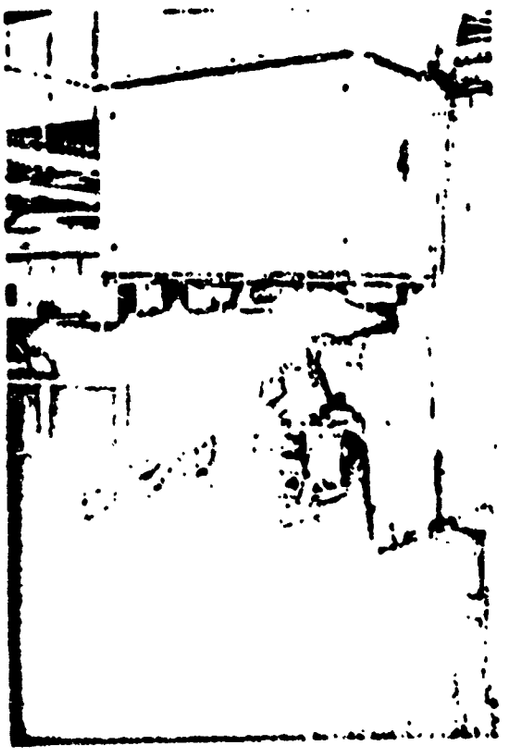


TYPICAL
SALEM FURNACE
PRODUCTION LINE



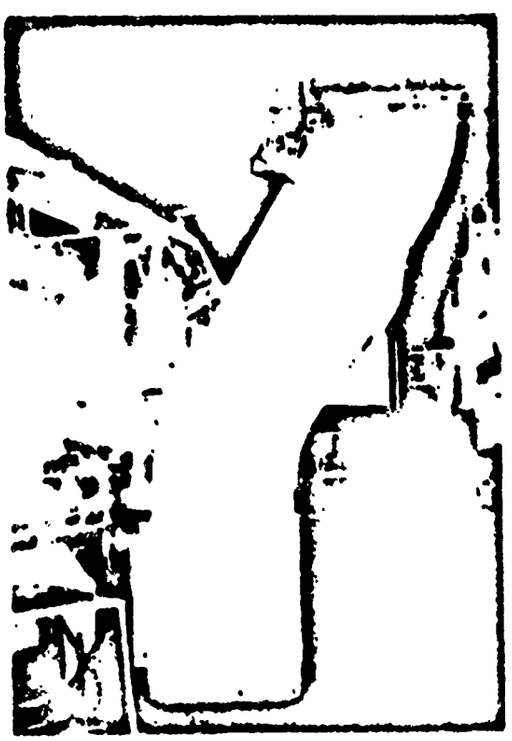
TYPICAL SALEM
DRYER

TYPICAL
SALEM FURNACE
COMBUSTION
AIR BLOWER



TYPICAL SALEM FURNACE
DISCHARGE END

SANDERS & THOMAS.



ROTARY FORGE FURNACE
FLUE GAS EXHAUST

DEFINITION OF TERMS

BENEFICIAL OCCUPANCY DATE (BOD)

The date a facility begins to operate.

BENEFIT-TO-COST RATIO (BCR)

The dollar savings realized over the life of the project divided by the non-recurring capital investment (including design). BCR is a measure of project payback. A BCR of 1.0, for example, means that the projects initial capital investment will be recovered over its lifetime.

CURRENT WORKING ESTIMATE (CWE)

The project installation cost escalated to the year the project is programmed for implementation. Installation costs are non-recurring and include all labor and material, contractor costs, bond, contingency, SIOH, and escalation. Design costs are not included and must be added to the CWE to develop the total project cost.

ENERGY-TO-COST RATIO(ECR)

The MBTU's per year saved divided by the non-recurring capital investment (excluding design). ECR is a measure of the amount of energy savings related to the required capital investment. Acceptable ECR's should be lower each year since energy costs escalate faster than capital investment costs.

MOBILIZATION STATUS

Period when the plant is operating at full production level.

SIMPLE AMORTIZATION PERIOD (SAP)

The project capital investment divided by the yearly savings. This yields the period of time required to recover the initial capital investment.

STANDBY STATUS

Inactive buildings or equipment that are maintained in a state of readiness for mobilization.

TOTAL INSTALLED COST (TIC)

The sum of the CWE and the design costs.